

1. GENERAL

One of the five major tasks of the Joint Typhoon Warning Center is to conduct limited tropical cyclone post-analysis and forecasting research, time and resources permitting. In most cases research projects are directly concerned with improvement of intensity forecasts or speed of movement and positioning forecasts of tropical cyclones. Meteorologists from outside agencies such as the Naval Environmental Prediction Research Facility, the Naval Postgraduate School, the 54th Weather Reconnaissance Squadron and Detachment 1, 1st Weather Wing often collaborate with JTWC on research projects. The following abstracts summarize research completed or underway during the past year.

2. CROSS-EQUATORIAL INTERACTIONS IN THE DEVELOPMENT OF A WINTER TYPHOON: NANCY 1970

(Guard, C. P., NAVENVPREDRSCHFAC TECH PAPER No. 4-76, UHMET 74-6)

Although winter typhoons can be as intense and destructive as seasonal ones, little research has been devoted to these "off-season tropical cyclones." This synoptic and dynamic study is of such a storm, Typhoon Nancy (19-27 Feb 70). It examines anomalies in the February 1970 circulation patterns over the Western Pacific and utilizes them to explain the formation and development of Nancy. Special emphasis is placed on the impact of cross-equatorial interactions during the storm's genesis. The study indicates that the rarity of "off-season tropical cyclones" may result, in part, from the absence of two conditions north of the equator during winter: low-level westerly winds and a sea surface temperature maximum. Evidence is also presented to suggest that the wall cloud and subsequent eye formation is contingent upon a rapid increase of upper level divergence above the developing system.

3. TROPICAL CYCLONE CENTER FIX DATA FOR THE 1975 TYPHOON SEASON

(Staff, FLEWEACEN/JTWC TECH NOTE 76-5)

A computer printout of all center fix data is displayed for each tropical cyclone occurring in the western North Pacific, the Arabian Sea and the Bay of Bengal during 1975.

4. AN EVALUATION OF UTILIZING EQUIVALENT POTENTIAL TEMPERATURE AS A MEASURE OF TROPICAL CYCLONE INTENSITY

(Milwer, F. P., FLEWEACEN/JTWC)

A post season evaluation of the credibility of the 700 mb equivalent potential temperature technique to forecast rapid or explosive deepening of tropical cyclones is currently in progress at JTWC. The technique utilizes values of Θ_e which exceed or equal 370°K (365°K

may be used if environment is favorable) to forecast rapid deepening within 12 to 24 hours (Sikora, 1976).

Preliminary results indicate that of the six storms that fell into the rapid or explosive deepening category during 1976, only two cases were found to correlate with a Θ_e between 365°K and 370°K prior to rapid deepening. In general, the high Θ_e values correspond to storms which were in the process of rapid or explosive deepening or had already peaked in intensity. The sample size was found to be too small to accurately determine the credibility of the technique, and an analysis of additional data is necessary to complete the evaluation.

5. RADIUS OF WIND FIELD SURROUNDING A TROPICAL CYCLONE

(Sokol, D., Metzger, G. P., Hern, R.L., FLEWEACEN/JTWC)

A preliminary analysis was conducted to determine the 100 kt, 50 kt and 30 kt wind radii surrounding a tropical cyclone, for use in cases when no detailed wind data are available. The 50th percentile was determined from a random sample based on JTWC warnings for super typhoons, typhoons and tropical storms.

6. CORRELATION OF JTWC INITIAL POSITION ERROR TO FORECAST POSITION ERRORS IN THE WESTERN NORTH PACIFIC

(Pilipowskyj, S., FLEWEACEN/JTWC)

A study correlating the JTWC initial warning position errors to 24-hour forecast errors shows a small but significant correlation. A regression analysis implies that 24-hour JTWC forecasts would improve to about a 90 nm vector error if the initial position error is reduced below 5 nm. Correlations for 48-hour and 72-hour forecasts are being calculated.

7. THE INFLUENCES OF THE TROPICAL UPPER TROPOSPHERIC TROUGH (TUTT) ON ERRATIC MOVEMENT OF TROPICAL CYCLONES

(Guard, C. P., FLEWEACEN/JTWC)

Although erratic movement has long presented a problem to the tropical cyclone forecaster, little light has been shed on the causes of this enigma. Frequently this movement has been attributed to "weak steering flow at mid-tropospheric levels". However, adequate explanations for this "weak steering flow" are lacking in the literature.

This study concentrates on the upper troposphere (200-mb level) where rawinsonde data is significantly augmented with aircraft reports. Results indicate a strong correlation between erratic movement of tropical

cyclones and movements of the TUTT. In many cases the TUTT is responsible for the entire erratic path of a tropical system; in others it merely initiates the abnormal movement.

8. THE DEVELOPMENT AND MOVEMENT OF TROPICAL CYCLONES IN DEEP SOUTHWESTERLY MONSOON SURGES

(Guard, C. P., FLEWEACEN/JTWC)

During August 1974 and September 1976 the western North Pacific was subjected to a stronger than normal southwesterly monsoon flow. This period was characterized by large pressure falls in the region of the near equatorial trough, strong southwesterly wind accelerations and deep southwesterly flow penetrating above the 500-mb level.

This study utilizes both satellite and synoptic data to illustrate the influences of this synoptic regime on the development, structure and movement of associated tropical cyclones.

9. OPERATIONAL APPLICATIONS OF A RECURVATURE - NON-RECURVATURE STUDY BASED ON 200-MB WIND FIELDS

(Guard, C. P., FLEWEACEN/JTWC)

One of the most difficult problems involving tropical cyclone forecasting is that of recurvature - non-recurvature. Colorado State University Atmospheric Science Paper No. 241, Tropical Cyclone Motion and Surrounding Parameter Relationships (John E. George, 1975) presented a recurvature - non-recurvature scheme based on 200-mb data composited from peripheral data surrounding 21 recurving and 21 non-recurving western Pacific typhoons. This 200-mb scheme was evaluated by JTWC based on 1974, 1975 and 1976 western North Pacific tropical cyclone data. Results indicated that even though the composited study required several alterations to be operationally practical, it provided a useful starting point. As a result, a follow-on recurvature - non-recurvature study was established, based on whether or not the Tropical Upper Tropospheric Trough (TUTT) is a persistent feature of the upper level synoptic pattern. Further evaluation is in progress.